On some Attempts to render the Luminous Prominences of the Sun visible without the use of the Spectroscope. By Warren De La Rue.

The progress of scientific discovery may be promoted by the record of one's failures, for it tends to prevent the same paths from being trodden by future explorers; on this account I venture to lay before the Society a description of some experiments on which I have been engaged since my return to Cranford in the spring of this year. Although these experiments have hitherto led to no satisfactory result, I am still pursuing them by varying the form of apparatus and the substances employed, in the hope of ultimately attaining the object in view. Notwithstanding the great success which has attended the study of the luminous prominences by Janssen, Lockyer, Huggins, Secchi, and more recently by Zöllner, it will be conceded that it is extremely desirable to find means of viewing these entities in their true position around, and on the Sun, without being compelled to distort the Sun's surface by spreading it out into an elongated sheet of light.

It must have undoubtedly suggested itself to many astronomers, that since the prominences emit light of but a few distinct and definite refrangibilities, it may be possible to absorb or to reflect out of the field of view the greater portion of all the other rays of the spectrum emanating from the Sun, by intercepting the light collected by an object-glass or mirror, by appropriate media. Indeed, the proposal of Huggins to combine the employment of the spectroscope with the use of absorbing media, naturally suggests the question,—why use the spectroscope at all?

The plan which I proposed to myself was twofold: to attack the F line on the one hand, and the C line on the other. In order to see the prominences by means of the F or green line, I adopted the following plan:—If the reader will suppose that in the case of a Newtonian, a right-angled prism is employed in lieu of the diagonal reflector, it will be evident that while the function of the hypothenuse is to reflect in totality the light it receives from the concave mirror, the two other sides of the prism are available for other objects, and may be covered by certain media through which the light must pass, and by which it may be altered in character by the reflection and dispersion into space of part of the rays, and the transmission to focus of others. The most promising covering medium for the right-angled surfaces of the prism appeared to me to be metallic gold, and fortunately the researches of Wernicke have furnished a means of obtaining a deposit of gold as brilliant and firmly adhering as the well-known silver deposits. The deposit of gold transmits a beautiful green, which includes the F line; and the Sun may be viewed without the slightest inconvenience after the light has passed through two films sufficiently thick. One advantage in gilding two surfaces of the prism consists in precluding the probability of any unaltered light from reaching the eye, for if minute holes occur in one film

it is not likely that others exist in the second film precisely opposite to them. The Sun's image when viewed through the gold films is beautifully defined, and perfectly cool, and very agreeable to the eye; indeed, if the hand be held in the principal focus of a 13-inch mirror, after the light has passed through the gold films, only a slight sensation of warmth is experienced; whereas a piece of wood, similarly placed, when the light is simply reflected by metallic mirrors or a prism not gilded, would soon be ignited: the gold film evidently, therefore, excludes most of the heat rays. Notwithstanding the hopes I entertained of rendering the prominences visible, I have not yet been able to succeed. There is, however, one circumstance which I ought to mention, because it may have contributed to the failure: it is this, it is extremely difficult to procure prisms in which the plane of the hypothenuse of the right-angled prism is truly parallel to the edge formed by the two sides at right angles. Very nearly true they are, but not perfectly so. In consequence of this imperfection, a great number of images of the Sun are seen (on account of a series of internal reflections), when the prism is held in the direction of the Sun; and although these may not overlap each other in the telescope, yet they cause an amount of diffused light which materially interferes with the possibility of seeing the prominences. The most obvious remedy is, of course, to try to procure a true prism; but the Astronomer Royal, to whom I imparted my difficulty, has suggested passing the light through pairs of prisms of small angle, superposed so as to form an optical monad, which would act as a parallel plate of glass, but in which the component prisms offer four sides which may be gilded. If one monad is not sufficient to screen away all the useless rays, then a second or a third might be used.

It may be mentioned that, in the case of the reflector, I have used a second smaller right-angled prism with two faces gilded, and placed between the eye-piece and the first prism before mentioned, and that the Sun's image was still very bright after passing through four films of gold. Also that I have employed a gilt prism with my 4-inch Dallmeyer.

It is not impossible that I may succeed in obtaining a photographic image of the prominences by using the gilt prism, even though I may not succeed in seeing them. Before, however, abandoning the attempt of rendering them visible by means of the gold films, I am having made sets of prisms, as proposed by Mr. Airy, and shall also endeavour to obtain true right-angled prisms; unfortunately, the Sun's low altitude will interfere for some months with the prosecution of the experiments.

Now, with regard to the C or red line, my plan of attack has been to employ red fluids, placed either between the eye-piece and mirror or object-glass, as the case may be, or between the eye-piece and eye. The two as yet experimented on without result are, a solution of carmine in ammonia, and a solution of aniline red in alcohol.

It is, of course, possible to ascertain beforehand whether the C ray is transmitted by the fluid, provided a suitable spectroscope is used; a trial showed that the red light transmitted by a solution of carmine in ammonia included the F ray, but this solution did not bring to view the luminous prominences. I am now preparing some pure carminic acid and some compounds of that acid for future experiments, and I am having a series of bottles made of larger capacity than those I have hitherto employed; for I have found that unless the light passes through one or two inches, or even more, of some of the coloured fluids, the eye is inconvenienced by the great brilliancy of the Sun's image. The vessels used have, of course, two sides of parallel glass.

On the Floor of Plato. By W. R. Birt.

During the last forty-eight years, occasional notices of the spots and marking on the floor of the walled plain *Plato* have appeared. In consequence of having given considerable attention to *Plato* and its surroundings in the years 1860 to 1863, I collected all the observations of the spots that I became acquainted with, numbering in the whole fifty-six, having reference to fourteen spots, two or three of which had been observed as craters, one being double. The greatest number observed *simultaneously* was seven, by Gruithuisen, in the year 1825. On the 23d of February of the present year, Mr. Pratt, of Brighton, observed with his 8-inch silvered-glass reflector eleven spots at the same time. They were not, however, eleven of the spots which had been observed previously, but included four unrecorded and a second double spot. Mr. Pratt has steadily continued his observations up to the present time, and determined the relative positions of twelve spots by alignment. Mr. Edward Crossley, of Halifax, has also kindly requested his assistant, Mr. Joseph Gledhill, to make continuous observations on them with his 9·3-inch achromatic by Cooke. The observations made by Mr. Gledhill and Mr. Pratt I have regularly received. The following are the names of the astronomers who have observed the floor of *Plato*. Gruithuisen, Mädler, Challis, Knott, the late Lord Rosse, the late Rev. W. R. Dawes, Baxendell, Dr. Dobie, Birt, Pratt, Crossley, Gledhill, and Elger, the number of observations being 297, in fifty series, and the number of spots observed twenty-five, including the companion of Dawes's double spot. In the annexed Table the number of each spot is given in accordance with the accompanying diagram, the name of the discoverer, the number of times each spot has been observed since the commencement of the present year, 1869, the comparative degree of visibility, that of the central spot, No. 1, being reckoned as unity, or 1·00, and remarks on the positions and general characters of the spots.